

# Notice of Allowability

Application No.

10/021,148

Examiner

Sath V. Perungavoor

Applicant(s)

KIM, YEONG-TAEG

Art Unit

2624

## -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 03/30/06.
2. ☒ The allowed claim(s) is/are 1,3,4,6-11,13-15 and 17.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☐ All    b) ☐ Some\*    c) ☐ None    of the:
    1. ☐ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
  5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
    - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
      - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
    - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

### Attachment(s)

- |   |  |
|---|--|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)  | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)            |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                | 6. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date _____. |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),<br>Paper No./Mail Date _____ | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment                    |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material          | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance   |
|   | 9. <input type="checkbox"/> Other _____.   |

### EXAMINER'S AMENDMENT

[1] An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mr. Michael Zarrabian (Reg. No. 39,886) on June 2, 2006.

The application has been amended as follows:

#### In claim 1

Please replace the subject matter in claim 1 with the following:

1. (currently amended) A method for enhancing an image, which comprises:  
obtaining a first image signal including pixel values;  
obtaining a high-pass image signal having high-frequency components of the first image signal;  
obtaining a positive non-zero weighting factor to control a degree of enhancement;  
selecting edge pixel values representing a boundary of an edge in the first image by evaluating two independent boundary-indicating conditions per pixel, including the steps of: evaluating if at least one side of the pixel is a constant image region, and evaluating if the pixel itself

Art Unit: 2624

is not in a constant image region, such that if both conditions are satisfied then concluding that the given one of the pixel values of the first image represents the boundary of the edge;

for suppressing shoots, defining a gain suppressing function having attenuation coefficients to be multiplied with particular pixel values of the high-pass image signal corresponding in location to the edge pixel values;

multiplying the high-pass image signal by the weighting factor and by the gain suppressing function to obtain a result; and

adding the result to the first image signal to obtain an enhanced image signal in which the shoots have been suppressed.

**In claim 2**

Please cancel claim 2

**In claim 3**

Please replace the subject matter in claim 3 with the following:

3. (currently amended) ~~The method according to claim 1,~~ A method for enhancing an image, which comprises:

obtaining a first image signal including pixel values;

obtaining a high-pass image signal having high-frequency components of the first image signal;

obtaining a positive non-zero weighting factor to control a degree of enhancement;

selecting edge pixel values representing a boundary of an edge in the first image;

for suppressing shoots, defining a gain suppressing function having attenuation coefficients to be multiplied with particular pixel values of the high-pass image signal corresponding in location to the edge pixel values;

multiplying the high-pass image signal by the weighting factor and by the gain suppressing function to obtain a result; and

adding the result to the first image signal to obtain an enhanced image signal in which the shoots have been suppressed;

wherein:

each of the pixel values of the first image signal is represented by  $f(m, n)$ , where  $m$  represents a vertical position and  $n$  represents a horizontal position;

a combination of the step of selecting the edge pixel values and the step of defining the gain suppressing function includes calculating:

$$f_L(m, n) = |f(m, n) - f(m, n - 1)|;$$

$$f_R(m, n) = |f(m, n) - f(m, n + 1)|;$$

$$d(m, n) = \min(f_L(m, n), f_R(m, n)); \text{ and}$$

$$x(m, n) = \begin{cases} \left( \frac{d(m, n)}{D} \right)^J, & \text{if } d(m, n) \leq D; \\ 1, & \text{otherwise} \end{cases}$$

wherein  $D$  and  $J$  are predetermined non-negative constants;

Art Unit: 2624

a combination of the step of selecting the edge pixel values and the step of defining the gain suppressing function includes calculating;

$$\Delta(m, n) = f(m, n+1) - 2 \cdot f(m, n) + f(m, n-1); \text{ and}$$

$$y(m, n) = \begin{cases} \left( \frac{|\Delta(m, n)|}{H} \right)^K, & \text{if } |\Delta(m, n)| \leq H; \\ 1, & \text{otherwise} \end{cases}$$

wherein K is a predetermined non-zero constant; and

the gain suppressing function is represented by  $\beta(m, n)$  and has properties defined by:

$$\beta \rightarrow 1 \text{ as } x \rightarrow 0 \text{ and } y \rightarrow 0;$$

$$\beta \rightarrow 0 \text{ as } x \rightarrow 0 \text{ and } y \rightarrow 1;$$

$$\beta \rightarrow 1 \text{ as } x \rightarrow 1 \text{ and } y \rightarrow 0; \text{ and}$$

$$\beta \rightarrow 1 \text{ as } x \rightarrow 1 \text{ and } y \rightarrow 1.$$

#### **In claim 5**

Please cancel claim 5.

**In claim 10**

Please replace the subject matter in claim 10 with the following:

10. (currently amended) ~~The method according to claim 1,~~ A method for enhancing an image, which comprises:

obtaining a first image signal including pixel values;

obtaining a high-pass image signal having high-frequency components of the first image signal;

obtaining a positive non-zero weighting factor to control a degree of enhancement;

selecting edge pixel values representing a boundary of an edge in the first image;

for suppressing shoots, defining a gain suppressing function having attenuation coefficients to be multiplied with particular pixel values of the high-pass image signal corresponding in location to the edge pixel values;

multiplying the high-pass image signal by the weighting factor and by the gain suppressing function to obtain a result; and

adding the result to the first image signal to obtain an enhanced image signal in which the shoots have been suppressed;

wherein:

each of the pixel values of the first image signal is represented by  $f(m,n)$ , where  $m$  represents a vertical position and  $n$  represents a horizontal position;

a combination of the step of selecting the edge pixel values and the step of defining the gain suppressing function includes calculating;

$$f_L(m,n) = |f(m,n) - f(m-1,n)|;$$

$$f_U(m,n) = |f(m,n) - f(m+1,n)|;$$

$$d(m,n) = \min(f_L(m,n), f_U(m,n)); \text{ and}$$

$$x(m,n) = \begin{cases} \left( \frac{d(m,n)}{D} \right)^J, & \text{if } d(m,n) \leq D; \\ 1, & \text{otherwise} \end{cases}$$

wherein D and J are predetermined non-negative constants;

a combination of the step of selecting the edge pixel values and the step of defining the gain suppressing function includes calculating:

$$\Delta(m,n) = f(m+1,n) - 2 \cdot f(m,n) + f(m-1,n); \text{ and}$$

$$y(m,n) = \begin{cases} \left( \frac{|\Delta(m,n)|}{H} \right)^K, & \text{if } |\Delta(m,n)| \leq H; \\ 1, & \text{otherwise} \end{cases}$$

wherein K is a predetermined non-zero constant; and

the gain suppressing function is represented by  $\beta(m,n)$  and has properties defined by:

$$\beta \rightarrow 1 \text{ as } x \rightarrow 0 \text{ and } y \rightarrow 0;$$

$$\beta \rightarrow 0 \text{ as } x \rightarrow 0 \text{ and } y \rightarrow 1;$$

$$\beta \rightarrow 1 \text{ as } x \rightarrow 1 \text{ and } y \rightarrow 0; \text{ and}$$

Art Unit: 2624

$$\beta \rightarrow 1 \text{ as } x \rightarrow 1 \text{ and } y \rightarrow 1.$$

**In claim 12**

Please cancel claim 12.

**In claim 16**

Please cancel claim 16.

**In claim 17**

Please make claim 17 dependent on claim 1.

**REASONS FOR ALLOWANCE**

[2] The following is an examiner's statement of reasons for allowance: The instant invention is an unsharp making method.

Prior art was found for the independent claims and applied in the non-final office actions. Applicant uniquely claimed a distinct feature in the instant invention, which are not found in the prior art, either singularly or in combination.

In claim 1, following claim limitation of "evaluating two independent boundary-indicating conditions per pixel, including the steps of: evaluating if at least **one side of the pixel is a constant image region**, and **evaluating if the pixel itself is not in a constant image region**, such that if **both conditions** are satisfied then concluding that the given one of the pixel values of the first image represents the boundary of the edge"



In claims 3 and 10, previously objected limitations have been placed into independent form.

These features were not found or suggested in the prior art.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

[3] Claims 1, 3, 4, 6, 7, 8, 9, 10, 11, 13, 14, 15 and 17 are allowed.

### **Contact Information**

[4] Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mr. Sath V. Perungavoor whose telephone number is (571) 272-7455. The examiner can normally be reached on Monday to Friday from 8:30am to 5:00pm.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Bhavesh M. Mehta whose telephone number is (571) 272-7453, can be reached on Monday to Friday from 9:00am to 5:00pm. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system,

Art Unit: 2624

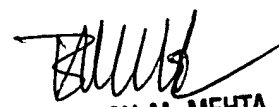
see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Dated: June 5, 2006

By: 

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For: Bhavesh M. Mehta

  
**BHAVESH M. MEHTA**  
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